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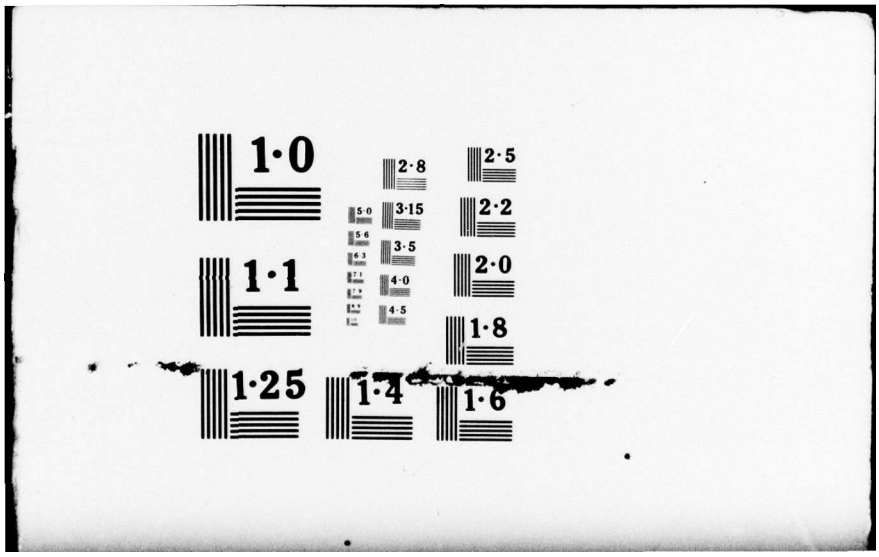
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ADAPTIVE ARRAYS FOR AM AND FM SIGNALS

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This report describes progress under Naval Air Systems Command Contract N00019-77-C-0156 during the third quarterly period. Research on the problem of integrating adaptive arrays into conventional modulation systems is summarized.

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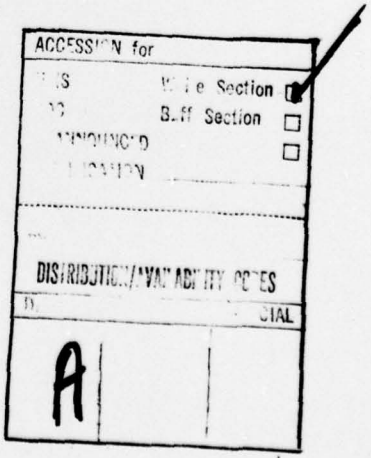
TABLE OF CONTENTS



INTRODUCTION

This report describes progress under NASC Contract N00019-77-C-0156 during the third quarterly period. There are three areas of work under this contract. The first involves experimental tests of an adaptive array in an AM communication system. The second involves array experiments with an FM communication system. The third consists of theoretical studies of methods of integrating adaptive arrays into other types of conventional communication systems.

The AM and FM communication systems involve the addition of a binary phase switching modulation on conventional AM and FM signals. The purpose of this phase switching is to allow the array to distinguish between the desired signal and interference. Implementation of the system with this phase switching requires an IF delay lock loop for the AM system and a Costas loop and baseband delay lock loop for the FM system, in addition to other minor circuitry.

PROGRESS

During the third quarter of this program, most of the work has involved the implementation of the AM system, as described below. A small amount of time has also been devoted to the problem of tagging single sideband signals in adaptive arrays.

A. Implementation of the AM System

Construction of a brassboard version of the coded AM reference signal generation circuitry is currently underway. The details of the circuits used were described in the second Quarterly Report[1]. A few minor changes have been made in the design, however, to improve performance. The most significant change was to the 1 kHz active bandpass filter design. For the filter design previously shown (Figure 2 of Report 4618-3), it was found to be difficult to obtain identical filter characteristics in the two channels required in the delay lock loop. That design did not have sufficient adjustment flexibility to enable the two channels to be matched properly. Instead we have substituted the filter design shown in Figure 1, for which center frequency, Q, and passband gain can all be separately varied.

At the end of the quarterly period, the brassboard version of the delay lock loop has been partially constructed. Construction will be completed during the fourth quarter.

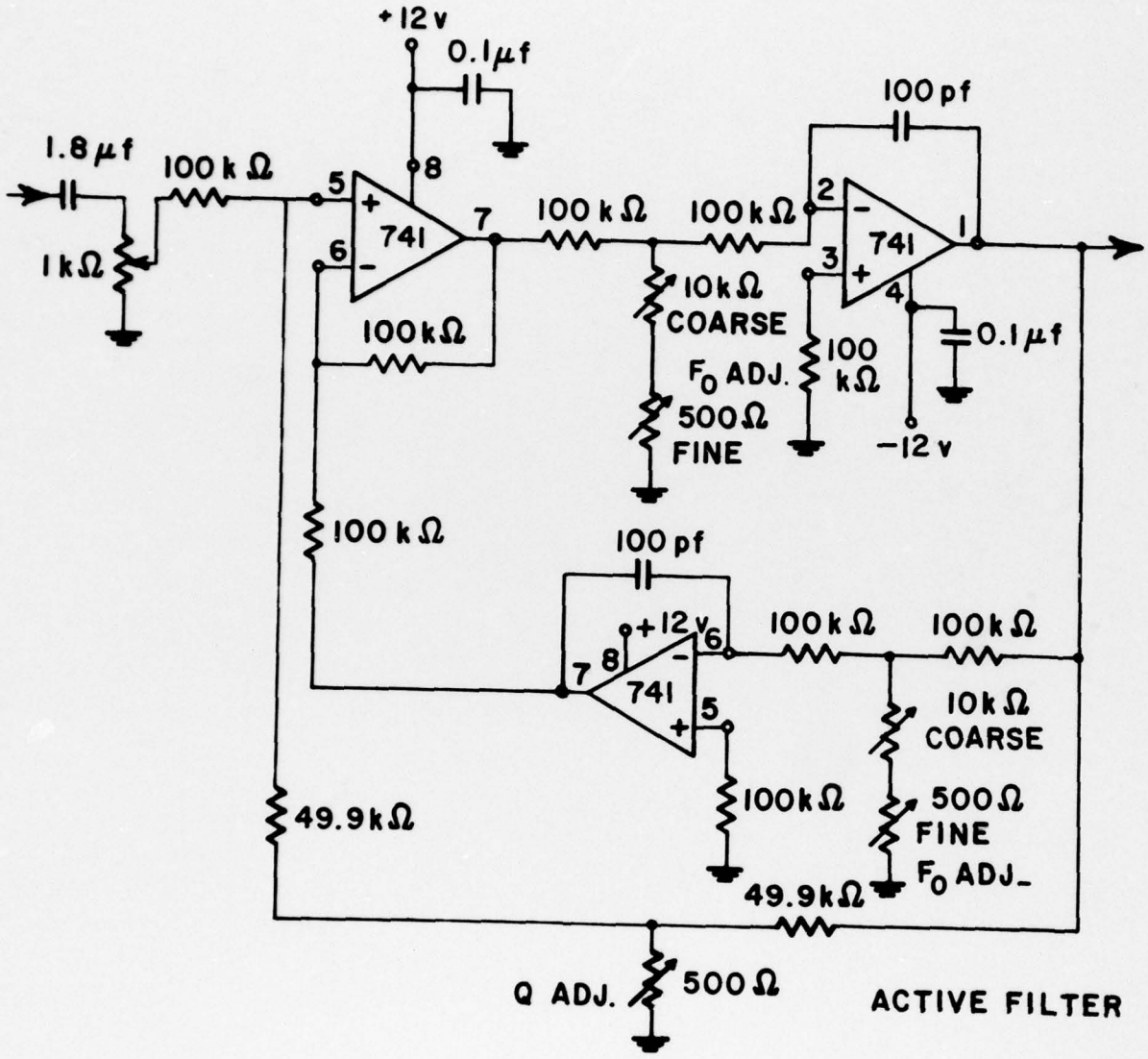


Figure 1. 1 kHz active bandpass filter.

B. Studies on Single Sideband Tagging

Studies on desired signal tagging and reference signal generation methods for single sideband signals have been started. The methods under study include the use of two-frequency tone modulation and pseudo-noise code modulation. Either of these modulations may be imposed in the form of product modulation or may be linearly added to the transmitted signal. The effect of such modulation on the correlation between the reference signal and interference is being evaluated.

PLANS FOR NEXT QUARTER

During the next quarter we plan to finish construction of the brassboard delay lock loop model for the AM system and to begin testing the performance of the adaptive array with phase-switched AM. Also, circuit design for phase-switched FM will be started. Finally, studies of tagging methods for single sideband will be continued.

REFERENCES

1. Compton, R.T., Jr., "Adaptive Arrays for AM and FM Signals," Quarterly Report 4618-3, June 1977, The Ohio State University ElectroScience Laboratory, Department of Electrical Engineering; prepared under Contract N00019-77-C-0156 for Naval Air Systems Command.